

**Attachment A**  
**to**  
**Report of the California ISO, the RTO West Filing Utilities,**  
**and the WestConnect Applicants Concerning Activities of**  
**the Seams Steering Group - Western Interconnection**

**Executive Summary**  
**SSG-WI Transmission Report**  
**Framework for Expansion of the Western**  
**Interconnection Transmission System**  
**October 2003**

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# **SSG-WI<sup>1</sup> Transmission Report Framework for Expansion of the Western Interconnection Transmission System October 2003**

## ***I. Executive Summary***

The Western Energy Crisis of 2001 raised a number of concerns regarding the impact of changes in the electricity industry on resource and transmission adequacy. The Western Governors' Association's (WGA) August 2001 report entitled, *Conceptual Plans for Electricity Transmission in the West*, recognized that the changing electrical industry regulatory structure has "uncoupled the historical linkages between new generation development and transmission construction" with no new industry structure to enable the construction of necessary transmission yet in place.

It is assumed that the three proposed western regional transmission organizations (RTOs) will eventually provide mechanisms to promote the construction of needed transmission infrastructure within their service areas. The SSG-WI Planning Work Group (PWG) was established to provide a forum to further the development of a robust West-wide interstate transmission system, an important pre-requisite for a seamless electricity market. Sub-regional transmission planning processes have also been established to facilitate transmission planning and expansion for specific geographic areas within the Western Interconnection (WI).

This report presents results from studies modeling transmission system congestion in the WI in 2008 and 2013 under different illustrative load and generation scenarios and assuming the dispatch of generation with the lowest operating costs first. The studies do not address transmission needed to maintain system reliability, to mitigate local market power problems, nor to optimize transmission/generation expansion. These studies were performed to identify West-wide transmission needs for a range of possible futures and possible options to meet these needs.

The establishment of the SSG-WI PWG, the development of these studies and the initiation of Sub-regional Planning Groups represent implementation of several important next steps identified in the WGA report along the continuum toward construction of critical transmission infrastructure. (See Figure E-3)

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<sup>1</sup> Seams Steering Group of the Western Interconnection (SSG-WI) is a voluntary alliance of representatives of the three RTOs and other stakeholders from the Western Interconnection (WI), whose purpose is to facilitate a seamless Western Market.

## **Study Objectives**

The studies were performed to meet the following three objectives:

1. To identify opportunities where the development of additional power transmission facilities could further facilitate competitive and efficient markets.
2. To provide policy-makers with information concerning transmission impacts of various energy policies being considered by State, Provincial and Federal entities.
3. To identify for generation developers major transmission additions that could be necessary to deliver a wide range of generation resources to load.

The 2008 study is considered the base case and only includes generation and transmission infrastructure reasonably certain to be in place by 2008. The 2008 study includes analyses under an average load forecast; low, average and high hydro conditions and a number of price ranges for natural gas. The 2008 study provides a benchmark for a 2013 load forecast by identifying congestion problems likely to occur if new resources and transmission are not developed.

The 2013 study evaluates the following three generation scenarios that are assumed to represent the bookends of possible generation infrastructure development in the 2013 timeframe.

- A gas-fired scenario that assumes 86 percent of new generation is fueled with natural gas and located near load centers;
- A coal scenario that assumes 66 percent of the new generation added between 2008 and 2013 is coal-fired; and
- A renewable energy scenario that assumes that 72 percent of new generation added between 2008 and 2013 is from renewable resources. The renewable energy scenario contains enough renewable energy generation to satisfy the Renewable Portfolio Standards that four states within the Western Interconnection have enacted.

As with the 2008 study, the 2013 study includes analyses under an average load forecast; low, average and high hydro conditions and a number of price ranges for natural gas.

## **Findings**

A comparison of the average hydro and medium gas price condition in the 2008 study with a similar study of an unconstrained transmission system (see Figure V-I in the report) indicates that there is significant stranding of low-cost generation in Canada and in the Desert Southwest. Approximately 1300 miles of new 345 and 500 kV line would be required to completely alleviate this identified congestion, which could result in an annual savings in the production cost of generation, or Variable Operating and Maintenance (VOM) costs, totaling at least \$110 million. One of the Sub-regional Planning Groups, the Southwest Transmission Expansion, or STEP Group, is already undertaking a more detailed investigation of upgrading existing lines and adding approximately 225 miles of new transmission line in the California-Arizona corridor. STEP estimates the benefit of this proposed project to be on the order of \$60 million per year.

The study did not explicitly model the impact of measures to reduce demand. However, the study results do provide insights into the effect of load reduction on the need for transmission. In addition, the study shows that the need for new transmission is more sensitive to the price of natural gas than to hydro conditions, primarily because new generation added in the WI between 1998 and 2008 is predominantly natural gas-fired with over 25% of generation resources in 2008 fueled by natural gas.

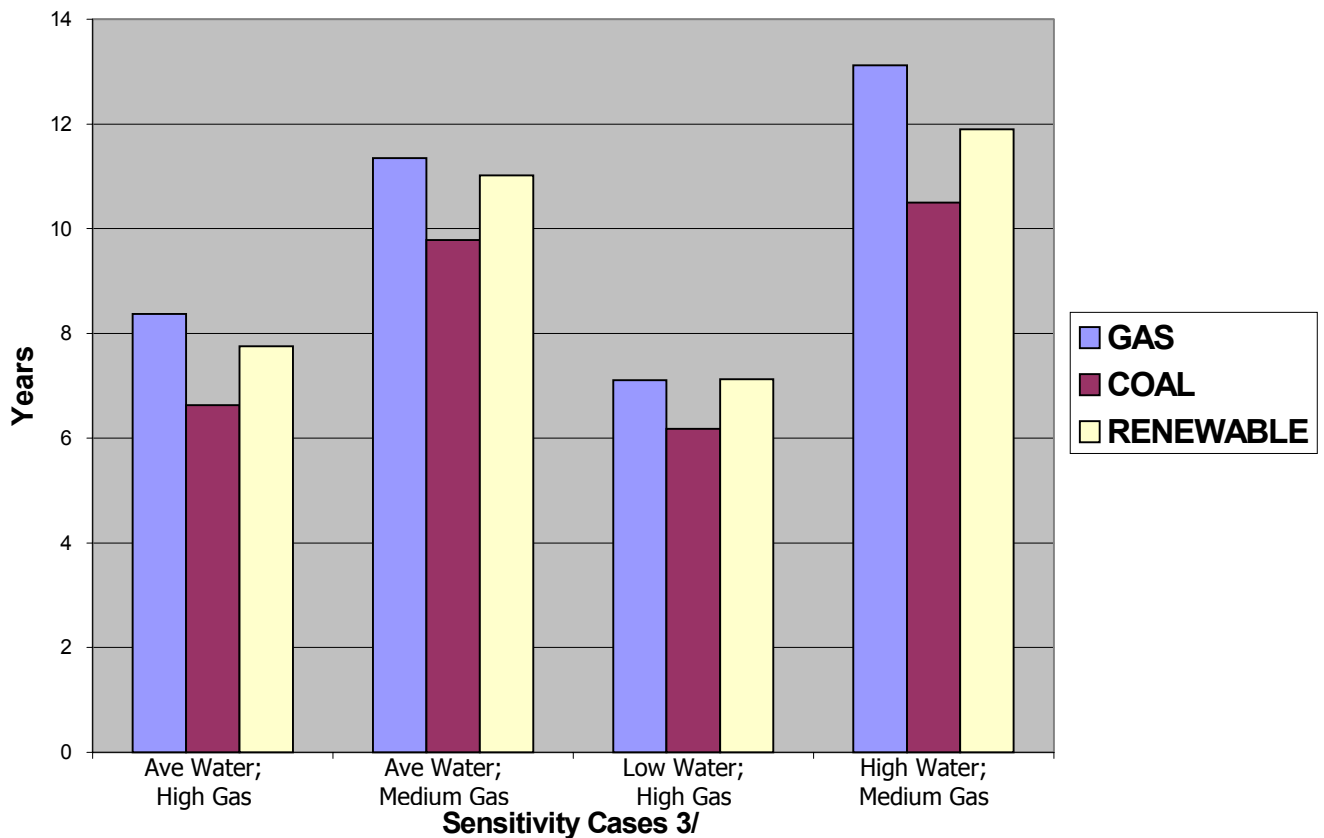
Figure E-1 shows the results of the 2013 scenarios in terms of the costs, benefits, and simple payback periods associated with constructing new transmission and generation infrastructure compared to the benchmark case of no new infrastructure. As shown, a cursory evaluation of the capital costs of transmission and generation infrastructure was performed. The benefits in terms of production cost savings (VOM cost savings) are derived from the model results. Such costs as the cost of additional gas pipeline infrastructure or the costs associated with potential carbon emission regulation have not been evaluated. Benefits stemming from reliability improvements, improved market competition and increased ancillary services have also not been quantified. Although the study results should not be construed to mean that a particular scenario is cost-effective to construct because there is a need for more detailed analyses, the results do show simple payback periods of 6 to 13 years for the range of scenarios and sensitivities studied. Expected generation/transmission scenarios for the various WI sub-regions merit further evaluation, including the consideration of non-transmission alternatives such as demand reduction measures.

The new transmission infrastructure assumed to be in place by 2013 under each of the scenarios to facilitate the efficient use of generation to meet load is graphically shown in Figure E-2. The underlying system represents that which would be operational by 2008.

**Figure E-1: SSG-WI Study Results for 2013 Scenarios**

	<b>GAS</b>	<b>COAL</b>	<b>RENEWABLE</b>
<b>New Transmission (Miles)</b>	1325	7600	3360
<b>New Transmission Costs (\$B)</b>	2.64	16.74	6.71
<b>New Generation (Installed GW)</b>	57	57	67
<b>New Generation Costs (\$B)</b>	17.44	30.51	36.76
<b>Production Cost Savings for Sensitivity Cases (\$B/yr) 1/</b>			
• Average Water; High Gas	2.40	7.13	5.60
• Average Water; Medium Gas	1.77	4.83	3.94
• Low Water; High Gas	2.83	7.65	6.10
• High Water; Medium Gas	1.53	4.50	3.65

**Simple Payback Periods for 2013 Scenarios 2/**



1/ Production Cost Savings are evaluated compared with a base case of 2008 resources & transmission.

2/ Simple Payback is defined as sum of all capital costs divided by total annualized benefits.

3/ Other factors to consider before investment decisions are made include: fuel availability/resource diversity, construction lead time, transmission losses, environmental impacts/benefits, benefits to transmission/generation reliability, impacts on market competitions, ancillary services impacts/benefits, etc.

## **Accomplishments in Meeting Study Objectives**

This report is an important step in meeting SSG-WI's transmission planning objectives and makes a valuable contribution to reestablishing the linkage between generation development and transmission construction.

### **STUDY OBJECTIVE 1: IDENTIFY TRANSMISSION INFRASTRUCTURE TO FACILITATE MARKETS:**

In furtherance of SSG-WI's first objective, the studies identify:

- Areas in the Western Interconnection that are or may be congested in the near future (2008); and
- Transmission facilities necessary to minimize production costs for three bookend generation scenarios;

Given the load and resource assumptions, these expansions of the transmission system are cost-effective. Further analysis is required before specific projects can be selected for construction.

Solutions are being investigated in sub-regional planning forums. Sub-regional transmission assessments can define specific projects, identify the beneficiaries of such projects, and create the coalition of interests necessary for transmission infrastructure implementation. An iterative transmission planning process has been defined. The iterative process includes annual studies by the SSG-WI planning function and detailed investigations by the Sub-regional Planning Groups and the RTOs (once they are formed). All of these activities will be coordinated with state entities and local utilities performing integrated resource planning. (See Figure E-3, for a graphical depiction of this process.)

The SSG-WI planning effort is currently based on the voluntary support of interested stakeholders. Given the diverse makeup of the Western Interconnection, a large number of individual transmission owners and other interested parties are involved in this effort. This approach to planning transmission can be successful; however, implementing the projects that are planned can be difficult because of the many interests involved. The development of RTO's is expected to significantly mitigate this barrier, as the RTO's will have processes that not only facilitate planning, but also fund and construct new transmission.

## **STUDY OBJECTIVE 2: IMPACT OF ENERGY POLICY ON TRANSMISSION:**

In furtherance of SSG-WI's second objective, the PWG:

- Finds that planning and implementation of transmission and generation infrastructure are difficult to coordinate because transmission infrastructure generally takes significantly longer to develop than generation infrastructure.
- Identifies transmission expansion that would relieve congestion for the coal, gas and renewable generation scenarios evaluated. (See Figure E-2)
- Finds that the transmission needed with the Renewable Scenario will support the amount of renewable energy generation necessary to satisfy the Renewable Portfolio Standards (RPS) that four states within the Western Interconnection have enacted.<sup>2</sup> Since the renewable generation levels in the Renewable Scenario exceed the RPS requirements, additional studies may be required to identify the minimum transmission required by the state RPS levels.
- Identifies transmission expansion that might lower electricity costs to consumers based on the preliminary economic analyses performed.

Energy policy-makers are currently faced with a number of issues and uncertainties that are tied directly or indirectly to transmission infrastructure development. National energy legislation may be forthcoming soon that addresses such issues as mandatory reliability standards, regional transmission organizations and electricity market designs.

In addition to transmission infrastructure adequacy, energy policy-makers are concerned with resource adequacy and diversity. A number of states within the Western Interconnection have enacted energy legislation that includes RPS, energy efficiency, environmental and other requirements. Following the Western Energy crisis of 2001, a number of states and regions are exploring whether to implement resource adequacy requirements. In addition, state regulators and load serving entities (LSEs) have renewed their efforts to perform integrated resource planning evaluations.

The scenario analyses performed by SSG-WI can help inform state policy-makers and regulators of the cost of transmission associated with alternative generation sources. This is valuable input into integrated resource planning activities, resource adequacy assessments and other evaluations being performed to address the issues identified above. These analyses are particularly valuable in providing insights into transmission additions that can support resource diversity and thus improve reliability. Conversely, the transmission infrastructure development process, graphically depicted in Figure E-3,

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<sup>2</sup> It is unclear whether the RPS requirements in the various states apply only to new, or also include existing renewable resources. The SSG-WI studies assumed that only new renewable resources count toward satisfying RPS requirements.

depends on input from states, LSEs and developers. Transmission planning must be integrated with utility and independent developer plans in sub-regional studies in order to arrive at solutions for transmission and generation infrastructure that fully support the goals of energy policy-makers. Finally, detailed analyses of the impact of transmission additions on system reliability need to be conducted.

### **OBJECTIVE 3: IDENTIFY TRANSMISSION NEEDED TO DELIVER RESOURCES TO MARKET:**

In furtherance of SSG-WI's third objective, the PWG finds:

- Gas-fired resources require significantly less new transmission since these resources are generally located near load centers.
- Significant transmission additions are required to transmit remote coal and renewable resources identified in the study to load centers. The results of this initial screening are promising in terms of identifying potentially cost-effective additions for the assumed resources scenarios.
- The transmission facilities identified for all of the scenarios may also provide reliability benefits for the WI power system.
- Certain transmission facilities were found to be needed in all three resource scenarios. Since the need for these facilities is less sensitive to resource assumptions, the sub-regional planning groups may want to focus first on these facilities as possible economic additions to the system.

As part of this initial study effort, a WI production-costing database has been developed. SSG-WI intends that this database be made available for use by the Sub-regional Planning Groups and others interested in joint database development. A beneficial and effective relationship has been established between the SSG-WI PWG and the western Sub-regional Planning Groups. These consensus-based efforts should be supported and encouraged to continue. These efforts will be expanded to include RTOs, once these are formed.

### **Next Steps**

The following steps are proposed to advance transmission development in the Western Interconnection:

- Federal, State and local policy-makers need to address and resolve institutional and financial barriers<sup>3</sup> to the construction of needed transmission infrastructure. These issues include transmission line siting, cost allocation and cost recovery. These issues need to be resolved to encourage investment in transmission infrastructure and demand efficiency measures at loads.
- The Sub-regional Planning Groups should perform more in-depth transmission expansion planning studies for those facilities within their sub-regions identified in this SSG-WI study, based upon expected generation additions and load forecasts (e.g. coordinated with utility integrated resource plans that are approved by state public utility commissions);
- SSG-WI should perform annual reviews of the utilization of the existing transmission system, potential future needs, and expansion issues, including those issues associated with differences in transmission and generation construction lead times. SSG-WI should coordinate its future study program with the Sub-regional Planning Groups. SSG-WI should initiate long-term planning efforts and identify appropriate cost and benefit indicators for future analysis, including fuel price volatility, fuel availability, environmental impact, ancillary service impacts, construction lead times, losses, reliability improvement and impacts on market competition.
- Development and funding of model and economic methodology improvements and forums to improve transmission planning methodologies need to be investigated and pursued. For example, study methodologies (particularly benefit calculations) need to be fine-tuned and improvements are needed to more accurately model hydro and wind resources as well as market behavior. A process for continuing the development of a common, public and consistent database needs to be finalized.
- Federal, state and local policy-makers will need to decide whether to finance and permit transmission expansions to facilitate generation resource diversity, including meeting renewable energy goals in RPS's.
- As Sub-regional Planning Groups perform detailed studies to identify beneficiaries and as incentive pricing and cost recovery issues are addressed and resolved, coalitions of interested parties will need to come together to plan, finance and construct critical transmission infrastructure. The development of RTOs will likely be critical to making mechanisms available to fund and construct new transmission infrastructure.

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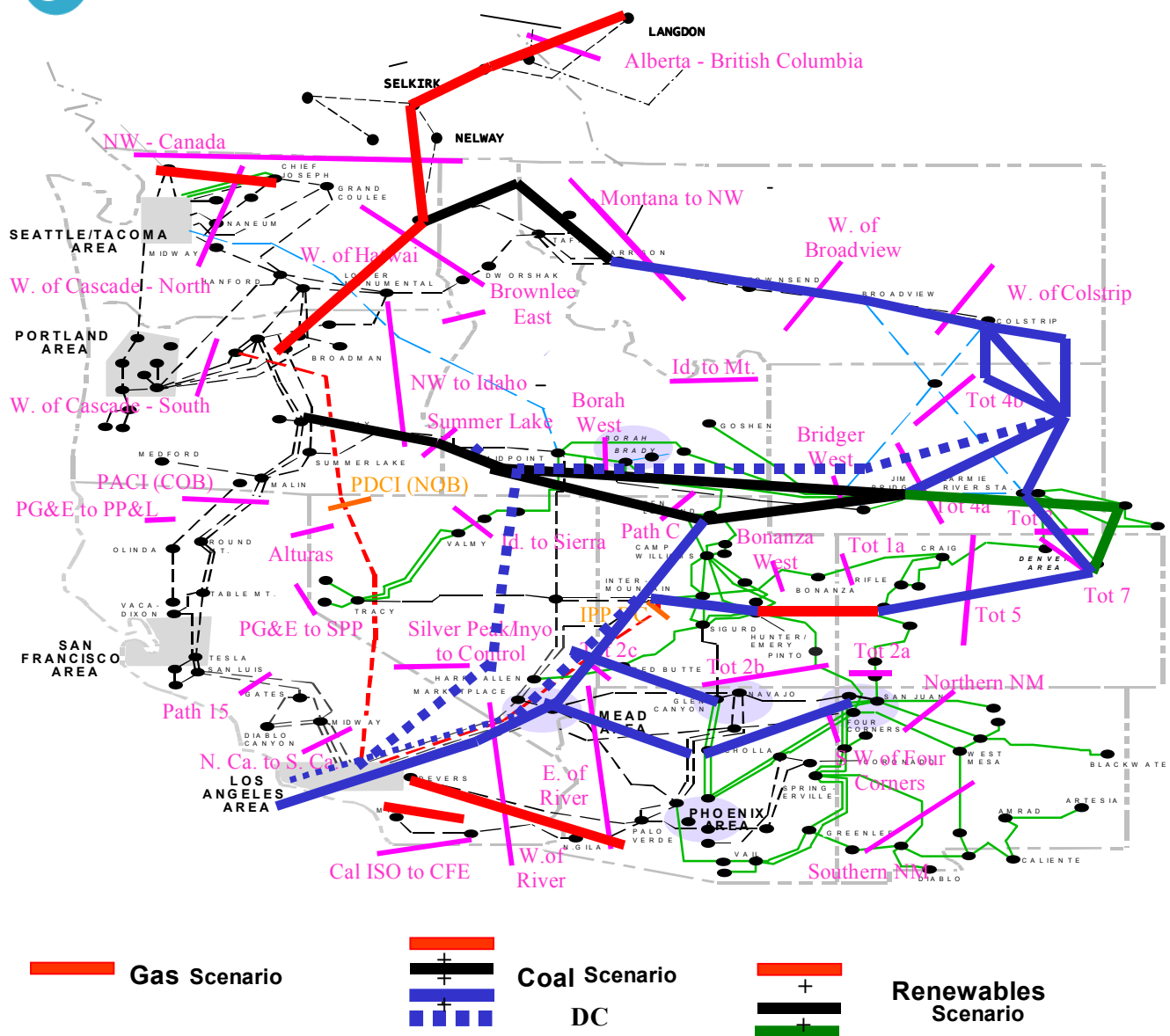
<sup>3</sup> Barriers exist that impede not only the construction of transmission lines, but also that impede demand-side technologies, including strategically sited generation, to delay or obviate the need for new transmission lines.

**Figure E-2 Western Interconnection Transmission Additions**



*Seams Steering Group of the Western Interconnection*

## Western Interconnect Transmission Paths



- 1 Alberta-BC
- 2 Alberta – Saskatchewan
- 3 Northwest – Canada
- 4 West of Cascades – North
- 5 West of Cascades – South
- 6 West of Hatwai
- 7 Blank
- 8 Montana to Northwest
- 9 West of Broadview
- 10 West of Colstrip
- 11 West of Crossover
- 12-13 Blank
- 14 Idaho to Northwest
- 15 Midway – Los Banos
- 16 Idaho – Sierra
- 17 Borah West
- 18 Idaho – Montana
- 19 Bridger West
- 20 Path C
- 21 Arizona to Calif
- 23 Four Corners 345/500
- 24 PG&E – SPP
- 25 PacifiCorp/PG&E 115 Intercon.
- 26 Northern – Southern Calif
- 27 Intermountain Power Project
- 28 Intermountain – Mona 345 kv
- 29 Intermountain – Gonder 230 kv
- 30 TOT 1A
- 31 TOT 2A
- 32 Pavant/Intermtn Gonder
- 33 Bonanza West
- 34 see paths 78 & 79
- 35 TOT 2C
- 36 TOT3
- 37 TOT 4A
- 38 TOT 4B
- 39 TOT 5
- 40 TOT 7
- 41 Sylmar to SCE
- 42 IID – SCE
- 43 North of San Onofre
- 44 South of San Onofre
- 45 SDG&E Comision Fed. de Elect.
- 46 West of Colorado River (WOR)
- 47 Southern New Mexico (NM1)
- 48 Northern New Mexico (NM2)
- 49 East of the Colorado River
- 50 Cholla – Pinnacle Peak
- 51 Southern Navajo
- 52 Silver Peak – Control 55 kv
- 53 Billings – Yellowtail
- 54 Coronado West
- 55 Brownlee East
- 56-57 Blank
- 58 Eldorado – Mead 230 kv Lines
- 59 WALC Blythe – SCE Blythe

**Figure E-3: Transmission Infrastructure Development Process**

